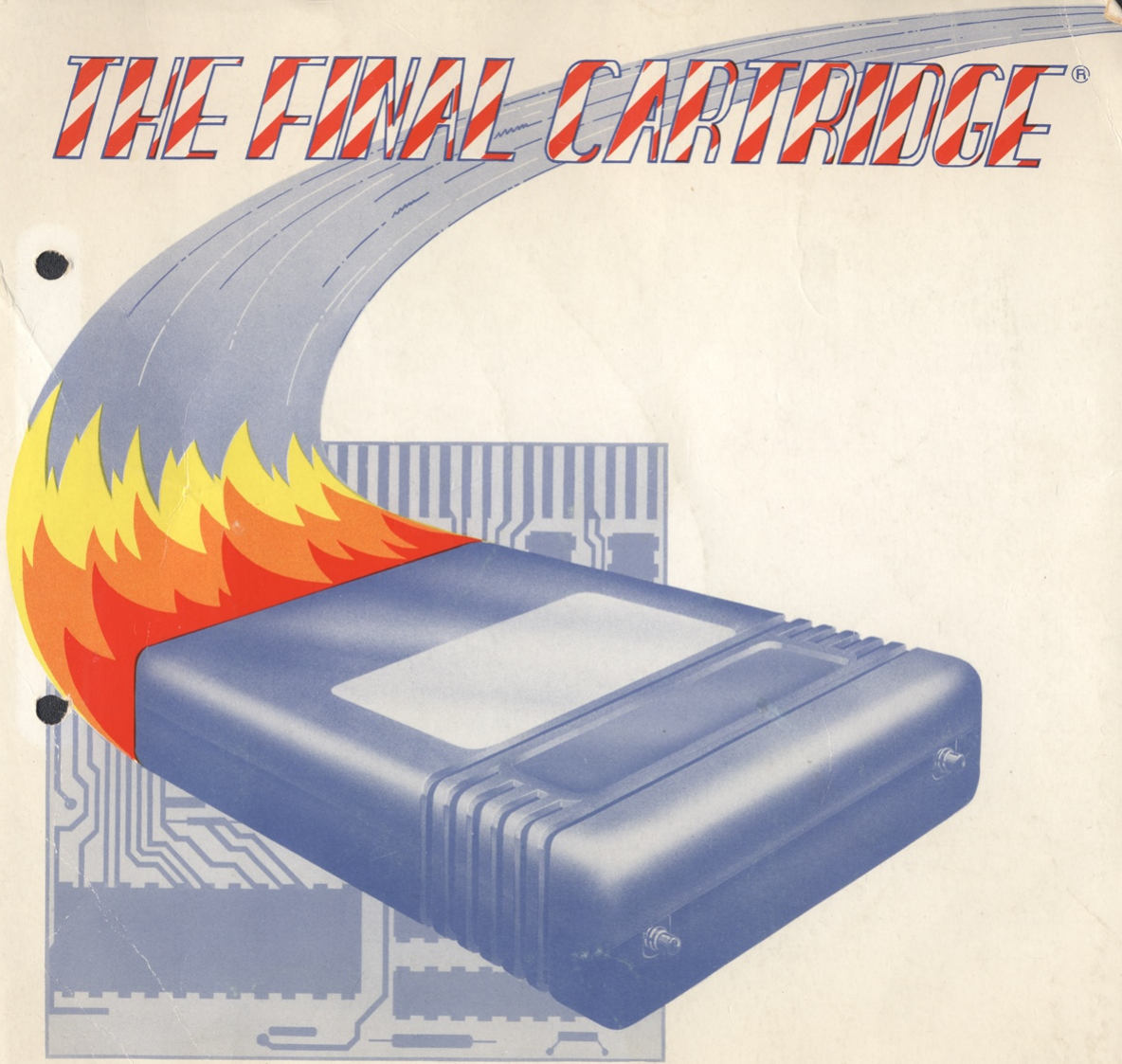
THE FINAL CARTRIDGE®



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CONGRATULATIONS!

You are now the owner of The Final Cartridge, the most useful utility ever produced for the Commodore 64 and 128. The Final Cartridge gives you many useful toolkit commands, allows you to use 24K of RAM which has never before been so easily usable, has a disk turbo which loads and saves FIVE TIMES faster, a tape turbo which loads and saves TEN TIMES faster, gives you proper disk commands, has a built-in machine language monitor, allows you to use a Centronics printer to produce listings and high-resolution graphics screen dumps and gives you function keys that work!

A freezer facility that will dump programs to tape or disk. A game killer equal to any dedicated game killer currently on the market. Perhaps the most important feature of The Final Cartridge is the fact that it operates completely outside the computer and so uses none of its memory.

The Final Cartridge also has a reset switch which will allow you to recover control of your computer at any time, and an OLD command so that you can get your BASIC program back after a reset or NEW.

This manual will guide you through the amazing features of The Final Cartridge and will later act as a reference guide to using the last utility cartridge you will need to buy.

GETTING STARTED

Commodore 64

Plug the Final Cartridge into the cartridge port of your computer (right hand side as you look from the front) with the LABEL UP. Turn on the computer and other peripherals as normal.

Commodore 128

Plug the Final Cartridge in as described above. Your C128 will now boot up in C64 mode. The Final Cartridge will have to be removed if you wish to use C128 mode.
Please note the Final Cartridge will NOT WORK in C128 or CP/M mode, and must be removed to operate in these modes.

Once you have followed the above instructions and turned your computer on you will see the normal start-up screen displayed. However, if you now press any of the function keys you will see they have functions assigned to them as described below.

The Function Keys

The eight function keys all now have commands assigned to them. These are as follows:-

f1	LIST
f2	MONITOR
f3	RUN
f4	OLD
f5	DLOAD
f6	DSAVE
f7	DOS"$
f8	DOS

You can use the function keys to speed up the loading of programs from disk considerably. The most convenient way to load a program is to press function key f7 to get the disk directory, then move the cursor up to the program which you would like to load and then press F5. The program will then be loaded in at 5 times normal speed. You may then press f1 to LIST the program (if its a BASIC program) or f3 to RUN it.

The new commands which are assigned to the function keys will be explained in full in the following pages.

The Freeze Button

The LEFT button on the back of the Final Cartridge is the Freeze Button. Once this button is pressed all programs will freeze and you will be presented with the following menu:-

FREEZE MENU ACTIVATED
f1=Menu.2 f3=Dsave f5=Tsave f7=Print

This is the first of several menus and can always be recalled from the other menus by pressing <RETURN>. All the functions of this and the other menus will be described in fuller detail later in the manual but briefly this is what happens when you select any of the options.:-
f1 Enters menu two (see below).
f3 Dumps programs in memory to disk.
f5 Dumps programs in memory to tape.
f7 Enters Print menu (see later).

Menu.2
f1=Run, will continue a program that has been stopped by the freeze button.
f3=Spr.1, kills sprite to sprite detection.
f5=Spr.2, kills sprite to background detection.
f7=Reset, enters reset menu (see later).

Print Menu
f1=Color.1, change text or foreground colours (remains changed).
f3=Color.2, change background colours (remains changed).
f5=Norm. Normal print and printer option menu (see screen dumps later).
f7=Rev. Reverse print and printer option menu (see screen dumps later).

Reset Menu
f1=Monitor, enter machine code monitor (see monitor chapter later)
f3=Start.Up, resets computer and reboots with cartridge enabled.
f5=Std.64, resets computer and reboots with cartridge disabled.
f7=User, see section on Monitor.

As you have seen most fuctions are quite easy to follow but please read the rest of the manual for more detailed explanations, it will save you a lot of time and trouble later. You will have no problems if you read all of the manual before you attempt any operation.

THE TOOLKIT COMMANDS

The Final Cartridge has several toolkit commands which make programming much faster and easier. These commands allow you to renumber a program, find a string, word or command, delete blocks of lines, recover a NEWed program, give you automatic line numbering, tell you where an error occured, and append one program onto the end of another.

AUTO

If you are typing in a program from a book or magazine then it can become very boring having to type in the line numbers, especially if they are evenly numbered (ie 10, 20, 30 etc). The Final Cartridge will AUTOmatically number your program, making the typing in of programs much faster and easier. For example,

```
AUTO 10,20
```

will print the number 10 on the screen, so that you may enter line 10 of your program, and when you press RETURN the number 30 will appear, and so on. When you have come to the end of the program just press RETURN without entering a command.

The first number after the AUTO command tells the computer the first line number of your program, and the second number tells it how much each line is to be increased by. So the command:-

```
AUTO 50,5
```

will give you line numbers in increments of 5 starting at line 50.

If you just type AUTO and then press the RETURN key then you will be given AUTOmatic line numbering starting at line 100 and going up in steps of 10.

DEL

Imagine that you are writing a long program and you decide that you do not need a particular routine which is about 20 lines long. To delete these lines the conventional way (ie by typing the line number of each line to be erased) would take quite a long time. However, The Final Cartridge saves your fingers and your computer's keyboard from all this extra work by providing a DELete command.

The format for the DEL command is very similar to that of the LIST command, so for example, to DELete all program lines up to and including line 50, you would type in:-

```
DEL -50
```

To DELete all lines between 150 and 255 you would type in:-

```
DEL 150-255
```

and to DELete all lines from line 452 onwards you would type in:-

```
DEL 452-
```

OLD

If you have typed NEW by mistake or have pressed the reset button all is not lost. To save the agony of having to re-type the whole program, The Final Cartridge has an OLD command which will recover a BASIC program after a reset or NEW. This command is very simple to use - just type OLD and your program will be back, as long as you haven't started to type in a new program or to LOAD one in.

RENUM

The RENUM command is very useful for when you are writing your own programs as it allows you to tidy up the line numbers. Imagine, for example, that you are writing a program and have been numbering the lines in steps of 10. You then discover that you need to add 15 lines between lines 50 and 60. There is obviously no way that they will fit, so what do you do? You simply use the RENUMber command built into The Final Cartridge. Using this command you could RENUMber the whole program in steps of 20 - giving you plenty of room to fit in those extra 15 lines. The RENUM command is used in this way:-

```
RENUM 10,20
```

This command will RENUMber the whole program in increments of 20, starting with line 10. The first number after the RENUM command is the starting line, and the second number tells the computer how much to increase each line number by. RENUM also takes care of any GOTOs and GOSUBs. Like AUTO, this command defaults to RENUM 100,10.

FIND

How many times have you tried to find a particular string in the middle of a very long program? The FIND command will search through the whole program for a string, word or

command and list every line in which it occurs. For example, the command:-

FIND "THE FINAL CARTRIDGE"
will list every line containing the string 'THE FINAL CARTRIDGE'.

FIND GOTO
will list every line containing the command GOTO.

FIND N$
will list every line containing the string variable N$.

HELP

The HELP command is very useful when you are trying to debug a program. If an error occurs then you simply have to type HELP and the offending line will be displayed on the screen. This command will only work after an error has occurred.

APPEND

Imagine that you are writing a program, and suddenly realise that you have a routine SAVEd on tape which you would like to include in your program. Normally it would be extremely difficult to get this routine from tape onto the end of your program, but the APPEND command makes this task very easy. You simply have to type APPEND to load the first program on tape, or APPEND"program name" to load a particular program, and the routine will be LOADed onto the end of the program already in memory. If you now type LIST you will see that you now have two programs loaded into memory, and the original line numbers are unchanged. You may then RENUMber the new program and re-SAVE it to tape or disk.

THE DISK COMMANDS

The 1541 disk drive is renowned for it's slow saving and loading speeds, and the difficulty which is encountered whenever you want to carry out any 'housekeeping' tasks (eg scratching a file, formatting a disk etc). The Final Cartridge solves many of these problems using the following commands:-

DOS"$

Having to type LOAD"$",8 and then LIST every time you want a directory of the disk can be very time-consuming, and of

course, this process wipes out any program you may have had in memory at the time. However, you can now forget all this inconvenience, as The Final Cartridge has an DOS"$ command, which will display a directory of the disk on the screen WITHOUT wiping out the program currently in memory. The command is extremely easy to use - just type DOS"$ OR press f7 and then press the RETURN key, and the directory of the disk will be displayed on the screen.

DAPPEND

This command is very similar in operation to the cassette-based APPEND command. Imagine, for instance, that you have two programs which you would like to join together. With the Final Cartridge this couldn't be easier. All you have to do is load in the first program as normal (or type it in), then type DAPPEND"program name", where 'program name' is the name of the second program, press RETURN and the second program will be appended onto the end of the one in memory. If you LIST the new program you will see that this is in fact the case. You may then RENUMber the complete program and re-save it to disk or tape.

DOS"

It is quite a long, boring process to format a disk, scratch a record, rename a file, or, in fact, carry out any 'housekeeping' tasks using the disk drive. Using the DOS" command built into The Final Cartridge, however, you can quickly and easily use any of the feature built into the 1541 (or 1570/1571 in C64 mode) which would normally be carried out by an OPEN 15,8,15:PRINT#15,"... command. For example, to scratch a program called 'PROG' from a disk you would simply type:-

```
DOS"SCRATCH0:PROG"
```

or even

```
DOS"S0:PROG"
```

To format a disk called UTILITIES 1, with an ID number 01, you would simply type:-

```
DOS"NEW0:UTILITIES 1,01"
```

If an error occurs whilst using the disk drive the only indication you have that an error has occurred is the red light flashing. To find out what kind of error has occurred

you simply have to type DOS" and press RETURN.

The DOS" command can be used with any of the disk commands listed in the 1541 (or 1570/1571) User's Manual.

DLOAD

If you want to load a program from disk you normally have to type LOAD"program name",8 or LOAD"program name",8,1. With The Final Cartridge, however, you simply have to type DLOAD"program name (you don't have to close the quotation marks). To load a program from a drive with device number 9, you would have to type DLOAD"program name",9 the first time. From then on, DLOAD will load all programs from device number 9 - to load from device 8 again, you would have to type DLOAD"program name",8. DLOAD will load a program from disk 5 times faster than normal, and will also display the start and end locations of the program being loaded.

You may find that some older commercial software does not seem to load correctly with DLOAD. This is because DLOAD is the same as LOAD"program-name",8,1. To overcome this, just type LOAD"program-name",8,1 - this will still load your program at the turbo speed.

DSAVE

This command, as you may have guessed, is used to save programs to disk. It is used in the same way as the DLOAD command, so to save a program called UTILITY to disk you would type DSAVE"UTILITY" and press RETURN. Again, to save a program to a drive with device number 9 you would type DSAVE"program name",9. DSAVE will save a program to disk from 3 to 5 times faster than normal, the time differences being due to any re-organisation of the disk which is necessary when a program is saved.

NOTE: You should use DSAVE to save your BASIC programs to disk at fast speed, and NOT the freeze facility as this will save more than is necessary for a simple BASIC program.

DVERIFY

DVERIFY"program name" has exactly the same effect as VERIFY"program name",8. In other words, the computer will compare the program on disk with the name 'program name' with the one currently in memory. If the two programs are the same then the computer comes back with the usual 'READY' prompt, but if there are any differences then a 'VERIFY ERROR' is

given. DVERIFY works at the normal slow speed.

THE TAPE TURBO

Tape users will no doubt be aware of the problems with the Commodore 64's slow loading speed. However, you will no longer have to wait great lengths of time while your programs are loading or saving, as The Final Cartridge has a turbo load and save routine which loads and saves TEN TIMES faster than normal.

The tape turbo routine replaces the normal load and save routine, and is activated as soon as you switch your Commodore 64 or 128 on with the Final Cartridge inserted and switched on. This means that all the normal tape commands (ie LOAD, SAVE, PRINT#, GET#, INPUT# etc) work as normal.

To save your program to tape at turbo speed you simply have to type SAVE "program name",7. Your program will be saved at ten times the normal speed. To reload your program just type LOAD "program name",7 and the program will reload at ten times normal speed.

To save and load programs at normal speed, save or load in the normal way ie. SAVE"PROG",1 or SAVE"PROG",1,1

One very important point to note is that the tape turbo load will only work on programs that have been saved using the cartridge turbo. This means that commercial software saved either at normal speed, or with another turbo routine CANNOT be loaded any faster until it has been resaved using the cartridge turbo. To do this would involve the speeding up of the cassette motor, which cannot be done by the computer.

OTHER USEFUL COMMANDS

The Final Cartridge has some other commands which you will probably find very useful.

LIST

The LIST command has now been improved so that any list protections which may be included in a BASIC program will be removed. This command is still used in the normal way. Pressing function key f1 also performs the LIST command.

MON or M <SHIFT> O

This command activates the machine-language monitor which is built into The Final Cartridge. Pressing function key f2 also has the same effect. Full details on how to use this excellent feature are given later on in this manual.

KILL

There are very few program that will not load with the cartridge enabled. However, should you have a program that will not load, just type KILL and proceed as per normal. Once your program has loaded you can re-enable the cartridge by pressing the FREEZE BUTTON, and then Dump your program to disk or tape. After freezing reset is automatic.

TYPE

This command turns your Commodore 64 or 128 and printer into an electronic typewriter. TYPE is explained fully later on in this manual.

USING HEXADECIMAL

The Final Cartridge allows you to use hexadecimal numbers in your programs, just as you would use decimal numbers. To tell the computer that a particular number is in hexadecimal you should precede it with a $ symbol. For example, this routine will fill the screen with @ symbols:-

```
10 FOR N=$0400 TO $07E8
20 POKE N,0
30 NEXT N
```

The start and end locations of the screen are given in hexadecimal in this program, and so are preceded by $ symbols.

THE CENTRONICS PRINTER INTERFACE

The Final Cartridge allows you to use a Centronics printer instead of a Commodore printer if you have a suitable cable (these are available from H & P Computers). Using this you can print high-resolution screen-dumps, low-resolution (ie text) screen-dumps, listings including all the Commodore graphics symbols, and, in fact, do everything you can do with a normal Commodore printer and more.

If you have both a Commodore and a Centronics printer connected, then switch off the printer you DON'T wish to use.

USING THE CENTRONICS INTERFACE

The device number for the Centronics printer is still 4, as The Final Cartridge will sense that a Centronics printer is present and send everything to that in preference to a Commodore printer. However, a secondary address must also be used to tell the computer what you want to do.

The Centronics interface is very easy to use - just follow the steps below, which give an example of how to use the interface:-

(1) Connect the printer to your Commodore 64 or 128 using the Centronics cable. One end of this cable has a 'D' plug on it which fits into the back of your printer. The other end has a connector which will fit into the User Port of your computer (MAKE SURE THAT THE COMPUTER IS SWITCHED OFF BEFORE YOU DO THIS!).
(2) Turn on the printer and computer and type in the command OPEN 1,4,9 <RETURN>CMD 1 <RETURN> . The word READY should be printed by your printer. If instead you get a 'DEVICE NOT PRESENT ERROR' check your printer is connected and switched on. The printer cable must also be wired correctly. Some printer cables that are purchased for other purposes may not be suitable. Please check with H&P for correct wiring details.
(3) Type PRINT #1,"THIS IS A TEST" and press RETURN. The message 'THIS IS A TEST' should be printed by your printer. You can type anything you like in place of the message 'THIS IS A TEST', including any of the Commodore graphics symbols, and they will be printed.
(4) If you have a program in memory then type LIST and the program will be printed out in full by your printer.

The OPEN 1,4,9 command told the computer to open a file to the printer, and give that file the number 1 (this is so that you can have several files open to various peripherals at the same time). The first 4 tells the computer that you want to use the printer, and the 9 is a 'secondary address' which tells the computer that you want to print all the Commodore graphics, normal characters and control codes, just as if you were using a normal Commodore printer. There are 7 different secondary addresses which you can use:-

0 - this secondary address should only be used with an MPS 803 printer or printer program.
1 - same as 0
2 - this secondary address allows you to use all normal ASCII codes.
3 - this allows you to use all ASCII codes, as well as the control code used by your printer.
7 - again, don't use this unless you have an MPS 803 printer.
9 - Prints all Commodore graphics and control codes
10 - The same as 9 but reverse print.

MAKING SCREEN-DUMPS

(Centronics and Serial printers)

If your printer has a bit-map mode (ie a Centronics printer with a minimum resolution of 960 dots across the page, a Commodore 801 or 803, NOT a Commodore 802 or 1526) then you can produce a screen-dump of either the text screen or the high-resolution graphics screen. This is very easy to do - all you have to do in order to produce a text screen-dump is press the FREEZE button on the left of the cartridge and then press function key f7. You may now change the background and foreground colours to improve the printed picture by pressing f1 for the background and f3 for the foreground colours. Then press f5 for a Normal Screen dump or f7 for a reverse scceen dump. Finally press f1 for Centronics screen dump or f3 for Serial screen dump. f5 resets the printer vectors just in case your program overwrites the Centronics Driver. 7 gives smaller linefeeds on good quality printers (this option will not work on all printers, but is especially important on printers using IBM control codes).

Producing a screen-dump of a high-resolution screen is just as easy. To do this you should follow these steps:-

(1) Load the program you would like to print into your Commodore 64 or 128.
(2) When the screen you want to print is on the screen press the FREEZE BUTTON
(3) Follow the instructions for a text screen-dump as above.
(4) Most programs will continue to run where they left off when the screen dump has been printed.

The Final Cartridge will produce a screen-dump taking up half a page of paper, and if multi-colour graphics are used then shades of grey will be printed instead of colour.

TYPE

With the aid of the TYPE command you can turn your Commodore 64 or 128 and printer into an electronic typewriter. The command is very easy to use - as shown below:-

OPEN 1,4,2 (or OPEN 1,4,7 if you are using a Commodore printer) <RETURN>
TYPE <RETURN>

If you now type some text and press the RETURN key your text will be printed out. You may correct any text before it is printed out using the normal cursor control keys and the delete key. Once your text has been printed you may type some more text, and print that out by pressing the RETURN key. Once you have finished using this feature you can return to using your computer as normal by pressing the RUN/STOP RESTORE.

The Freeze Facility

The Final Cartridge has a facility built in to allow you to make backup copies of your tape and disk programs. Please note that this facility is only for your own personal backups, and is not designed to allow you to copy programs illegally. Disk programs saved using the freezer can be reloaded without the cartridge still at turbo speed. Tape programs require a comparable turbo in order to be loaded back without the cartridge.

To make a backup copy of your software, follow these simple steps:-

(1) Turn on your computer with the cartridge on, as described in the Getting Started section.
(2) If your program will not load with the cartridge working (eg if it is tape-based), or if the program is for someone else (remember - this is ILLEGAL) then type KILL.
(3) Once the program is loaded and running press the FREEZE BUTTON. This will take you to the freeze menu.
(4) If you wish to save the program to disk, press function key f3=Dsave. To save to tape press function key f5=Tsave.
Your program will then be saved. Press the reset button to

reset the computer.

There are a few points to note about the freeze facility. These are as follows:-

(1) Never freeze while the disk drive is running

(2) The printer must be turned off whilst saving a frozen program

(3) Always start from a 'clean' machine, since programs are saved in a compacted form and this will make sure that nothing unnecessary is saved. Use the reset menu.

(4) Always freeze the program when it is on it's start-up menu, as when you load your frozen program back from tape or disk it will run from the point at which you froze it.

(5) Some program will not load using DLOAD. The simple answer to this is, use a normal LOAD"prog",8 from Disk or ,7 from Tape and then run as above.

As far as we are aware the freezer will make backup copies of any program but with new protection methods being developed we cannot guarantee this will always be true.

Frozen programs will always be saved in two parts under the name FC and -FC. You can, of course, rename your program if it was saved on disk but you must rename both parts. It is important to rename the second part with a - before the name and both parts MUST have the same name. To do this, use the DOS" command, as follows:-

```
DOS"R0:prog=FC"
DOS"R0:-prog=-FC"
```

where 'prog' is what you want to call your program (up to six characters only)

To load your frozen programs back you must first switch of the computer and then on again. Load your disk program be typing DLOAD"PROG" or use f7 and f5. When the loader has loaded type RUN or f3 the remainder of the program will then load. If the program you want to load is the first one on the disk you can press f5 and then f3 to run it.

NOTE: TO RELOAD TAPE PROGRAMS TYPE: LOAD" ",7

SPRITE KILLER

Pressing the FREEZE button and then f1 will take you to menu 2. If you then press f3=Spr.1 you will disable the sprite to sprite detection. This takes about 10 seconds then the program will restart. You may then repeat the above operation but this time press f5.Spr.2 to kill spite to background detection.
Please remember that not all games use sprites, so don't be surprised if you still get killed - what you thought were sprites are probably something else! and once killed sprites cannot be reset.

THE MONITOR

The Final Cartridge is equipped with a very good machine-language monitor which will allow you to write your own machine-language programs. This monitor has several advanced features, such as bank switching (so that you can use the RAM which is 'under' the BASIC and Kernal ROMs) and the ability to scroll backwards and forwards through a dissassembly.

There are three ways to enter the Monitor. The first of these is to simply type M shift-O and press RETURN. Alternatively, you could just press function key f2. The third way is to press the freeze button on the back of The Final Cartridge, then press function key f1, then fuction key f7 and finaly function key f1.

THE REGISTERS

Once you have entered the Monitor you will be given a display of the various registers, looking something like this:-

```
C*
    PC  IRQ  SR AC XR YR SP
.; B39F EA31 37 40 27 84 FF
```

These registers are the Program Counter, Interrupt ReQuest, Status Register, ACcumulator, X Register, Y Register and Stack Pointer. You can obtain this information at any time simply by typing R and then pressing RETURN.

LOOKING AT THE MEMORY

One of the simplest functions of the Monitor is to display the contents of a block of memory, both in hexadecimal format and, where possible, as a character (ie a letter, number or graphic symbol). The command to do this is M. So, for example, to display the contents of memory locations 8000 to 8100 (hexadecimal) you would type:-

```
M 8000 8100
```

The contents of these memory locations will then be displayed on the screen. The first number on each line (which is a four-digit number) is the memory address in hexadecimal. The eight two-digit numbers are the contents of that memory location and the seven memory locations following it. At the end of each line is a series of eight characters. The eight two-digit numbers are the ASCII codes of these characters.

If you want to carry on looking through the memory from location 8100 onwards you can simply move the cursor down off the bottom of the screen using the cursor-down key. The Monitor will carry on dissassembling until you release the cursor-down key. If a particular memory location that you wanted to look at scrolls off the top of the screen then you should simply use the cursor-up key to move the cursor up off the top of the screen, and you will be able to move BACKWARDS through memory. You can also use function keys f3 & f5 to move either to the top or bottom of the screen.

You may only want to look at the contents of one or two memory locations, and to do this you should simply type the command M followed by the first memory location that you want to look at. The contents of this memory location, and of the seven memory locations following it will then be displayed. For instance, to look at the contents of memory locations 4000 to 4007 (hexadecimal) you would simply type:-

```
M 4000
```

Of course, if you decide that you would like to look at the memory locations before or after locations 4000 to 4007 you can move the cursor off the top or bottom of the screen accordingly.

LEAVING THE MONITOR

Once you have finished using the Monitor you should simply type X and press RETURN. You will then be back in BASIC.

ASSEMBLING MACHINE-LANGUAGE PROGRAMS

The Monitor has a built-in assembler which allows you to write your own machine-language programs. Try this short example program:-

```
A1000 LDA #$01   (NO SPACE BETWEEN THE FIRST A)
A 1002 STA $0400
A 1005 LDA #$00
A 1007 STA $D800
A 100A BRK
```

As you enter each line of this program the Monitor will alter what you have entered so that it looks like the program listing below. A letter A will also be displayed at the start of the next line, together with a memory address, ready for you to enter some more of the program. When you have finished just press RETURN. The final program will look like this:-

```
A 1000   A9 01        LDA #$01
A 1002   8D 00 04     STA $0400
A 1005   A9 00        LDA #$00
A 1007   8D 00 D8     STA $D800
A 100A   00           BRK
A 100B
```

The display now shows the memory locations used by each instruction (on the left), the assembled program (in the centre) and the un-assembled program (on the right).

RUNNING MACHINE LANGUAGE PROGRAMS

You can execute the above program simply by typing:-

```
G 1000
```

As soon as the RETURN key is pressed a black letter A will appear in the top left-hand corner of the screen.

The G command tells the Monitor to start executing a machine language program starting at the memory location given, so the above command tells the Monitor to execute the machine language program starting at memory location 1000 (hexadecimal).

DISASSEMBLING MACHINE LANGUAGE PROGRAMS

The Monitor built into The Final Cartridge has the ability to disassemble a machine language program (or, in other words, convert it from a hard-to-understand list of numbers into a more readable list of commands). This is done by using the D command. So, for example, to disassemble the short program we entered above we would type:-

```
D 1000 100A
```

Or, to start disassembling a long program starting at memory location 2AFE (hexadecimal) you may just type:-

```
D 2AFE
```

This will disassemble one command only, and to continue you should move the cursor off the bottom of the screen, or alternatively move the cursor off the top of the screen (to disassemble backwards).

SAVING AND LOADING MACHINE LANGUAGE PROGRAMS

Once you have written your machine language program you will no doubt want to save it to either tape or disk. This is very easy to do - all you have to do is tell the Monitor the name of the program, whether you want to save to tape or disk, and the start and end locations of the program. So, to save the program we wrote earlier, we would type:-

```
S "DISPLAY",01,1000,100B
```

You will probably notice that we have to add 1 to the end memory location, as the save routine will save from the start location up to, but not including, the end location.

The above command saves to tape, but to save to disk you simply have to change the device number (the 1 in the above command) to an 8, like this:-

```
S "DISPLAY",08,1000,100B
```

Loading back machine language programs is just as easy. Simply type L followed by the program name and the device number. So to load our program from tape we would type:-

```
L "DISPLAY",01
```

and to load it from disk we would type:-

```
L "DISPLAY",08
```

You can also perform a relocated load by adding a relocate address, eg:-

```
L "DISPLAY",01,4000
```

would load the program 'DISPLAY' from tape and store it in memory locations 4000 (hexadecimal) onwards. Of course, you can perform a relocated load from disk by changing the command to:-

```
L "DISPLAY",08,4000
```

FILLING AN AREA OF MEMORY

It can often be useful to quickly fill an area of memory with a number. This is accomplished by using the F (for Fill) command. All you have to do is specify the start and end locations of the block of memory to be filled, and the value that you want to store in all those memory locations. For example, to fill memory locations 1000 to 2000 (hexadecimal) with the value 2A you would type:-

```
F 1000 2000 2A
```

If you now type:-

```
M 1000 2000
```

TRANSFERRING BLOCKS OF MEMORY

The Transfer command is very useful for copying a block of memory from one place to another. You can see how this command works by typing:-

```
T 0000 03E8 0400
```

As soon as you press the RETURN key the screen will fill up with 'rubbish'. This in fact the contents of the first 1000 bytes of the Page Zero RAM, as the Transfer command above copies the contents of memory locations 0000 to 03E8 (which is part of the Page Zero RAM) into memory locations 0400 onwards (which is the screen memory).

Please note that you cannot Transfer a block of memory up within itself. eg a command such as this would cause some unexpected results:-

T 2000 2080 2010

COMPARING BLOCKS OF MEMORY

The Compare command will compare one block of memory with another, and inform you of any differences, if any. For instance, if you type:-

C 2000 3000 4000

then the screen would rapidly fill up with numbers. The numbers being displayed are the memory locations which are not the same. So if you were to compare two blocks of memory that are identical then nothing will be displayed on the screen. As normal, the first number after the C command is the start of the block of memory, the second number is the end of that block of memory, and the third number is the start of the second block of memory.

HUNTING FOR NUMBERS

The Final Cartridge has a very useful Hunt facility. As you may have guessed, the H command will search through a block of memory for a number or group of numbers. For instance, if you were to type in:-

H 8000 A000 FF

then all the memory locations between 8000 and A000 (hexadecimal) which contain the value FF (hexadecimal). If you wanted to find all the memory locations which contain a group of values, then you would simply use a command similar to this:-

H 7000 C000 1A 2C FD

This command will search through memory locations 7000 to C000 (hexadecimal) for the values 1A, 2C and FD (hexadecimal) in a group, and display all the memory locations in which they occur.

BANKSWITCHING

With the aid of the bankswitching command you can store machine language routines under the ROMs. The command is very easy to use, to switch out all the ROMs you would use the command:-

O4 (the letter 'O' not zero)

and to get back to normal you would type:-

```
O7
```

USING THE DISK DRIVE FROM THE MONITOR

The Final Cartridge allows you to use all the features of the disk drive from within the Monitor by the use of the @ command. For instance, to display a directory of the disk without wiping out the program currently in memory you would type:-

```
@$
```

and to format a disk, giving it the name DISK1 and the ID number 01 you would type:-

```
@NO:DISK1,01
```

Any of the disk commands given in your disk drive manual can be used in this way (eg @SO:GAME will scratch the program called GAME).

PRINTING MACHINE LANGUAGE

If you want to print out a block of machine language then you can press P <RETURN> all output will now be to the printer. Pressing P again will return output to the screen.

CONVERTING HEXADECIMAL TO DECIMAL

As you will have gathered by now, the Monitor expects all numbers to be in hexadecimal. For this reason the Monitor is equipped with a decimal to hexadecimal and hexadecimal to decimal convertor. If, for example, we wanted to know what the number 40960 was in hexadecimal we would simply type:-

```
#40960
```

and the equivelant number in hexadecimal (A000) will be displayed on the screen. If you wanted to find the decimal value of, for example, 10FF you would type:-

```
$10FF
```

and the number 4351, which is the decimal equivelant of 10FF, will be displayed on the screen.

DISK MONITOR

The Final Cartridge also allows you to manipulate blocks of information directly on disk, using sector read and write commands. These are very easy to use, for example to read track 1 sector 2 into memory you would type:-

*R 01 02

this would load track 1 sector 2 into memory at the default starting address of CF00 (hexadecimal). Please note that all numbers should be in hex for this part of the monitor, eg

*R 0A 0B CE

would load track 10 (0A hex), sector 11 (0B hex) into memory starting at CE00.

Writing a sector back to disk is very similar, eg

*W 0A 0B CE

would write the block of memory from CE00 onwards to track 10 sector 11 of the disk.

While a sector is in memory you can alter it in any way you wish using the Monitor's commands, and then write it back to disk when you have finished. Please remember that you could corrupt a disk and lose all information on it if you are not careful, so practice on a blank disk first, and always try to make any alterations on a backup disk if possible.

It is also possible to use all the Monitors facilities to examine the disk drive's memory. If you type OD <RETURN> you may use all the Monitor commands as normal, but the disk drive's memory can be examined. Command's OD, $, *R, *W and P do not have any affect in this option.

FUNCTION KEYS FROM MONITOR

When using the monitor, the following function keys do the following:-

f1 - not used
f3 - Home Cursor
f5 - moves cursor to bottom left hand corner of the screen
f7 - disk directory

THE USER FACILITY

As mentioned at the beginning of this manual, there is a facility for the user to write their own reset routines. To

do this you simply have to alter the contents of memory location 0334 (hex) to FE (hex), then put the memory location of your routine in locations 0335 and 0336 (hex). So, for example, if you store 00 in location 0335, and 10 in location 0336 (all hex), then enter the example program given in the Assembling section above, then whenever you use the User option of the reset menu a black A will be displayed in the top left hand corner of the screen. You could just as easily write a routine which sets up your favourite screen colours, for example.

MEMORY READ AND MEMORY WRITE

With the aid of The Final Cartridge you can access the 24K of RAM which normally lies 'under' the ROMs. This extra memory can be used as a storage medium for large amounts of information, such as variables, text and graphics screens, look-up tables etc.

There are two extra commands which enable you to use this memory - MR and MW (for Memory Read and Memory Write). Before these commands can be used, however, they must be initialised with the instruction SYS 57280. These commands must be initialised as they are not normally resident in the computer's memory so as to retain compatability with existing software. This short program illustrates the MR and MW commands:-

```
10 SYS 52780
20 MR1024
30 MW60000
```

If you RUN this program the MR and MW commands will be initiallised by line 10. The MR command in line 20 will read 192 bytes of memory from locations 1024 onwards (these are the first 192 bytes of screen memory) and the MW command in line 30 will then write the same 192 bytes to memory locations 60000 onwards. This effectively means that the first 192 characters on the screen have been copied to memory locations 60000 to 60191. To see that this has in fact happened you should clear the screen and enter this short program:-

```
10 SYS 57280
20 MR60000
30 MW1024
40 FOR N=55296 TO 55488:POKE N,1:NEXT N
```

You should be able to follow what is happening in this

program. Line 10 initialises the MR and MW commands, line 20 reads 192 bytes of memory from memory locations 60000 onwards (this is where we stored part of the screen), and line 30 writes those 192 bytes to locations 1024 onwards (back onto the screen). Line 40 just POKEs some colour into the first 192 bytes of colour memory as some Commodore 64s need this.

The following program shows how the MR and MW commands can be used to transfer blocks of memory into a variable. Type it in and RUN it, then read the explanation to see how it works.

```
10 SYS 57280
20 BUFFER$=""
30 X=PEEK($2E)*256+PEEK($2D)
40 POKE X+2,192
50 POKE X+3,60
60 POKE X+4,3
70 MR $0400
80 A$=BUFFER$
90 PRINT"<SHIFT-CLR/HOME>";
100 FOR N=1 TO 192
110 POKE 1023+N,ASC(MID$(A$,N,1))
120 POKE 55295+N,1
130 NEXT N
```

Here is a simple description of what each line of the program does:-

Line 10 - initialises the MR and MW commands.
Line 20 - clears the string variable BUFFER$.
Line 30 - gives the variable X the value of the start of BASIC variables.
Line 40 - sets the length of the string to 192 bytes.
Lines 50 & 60 - specifies the start location of the string (3*256+60=828 which is the start of the tape buffer).
Line 70 - reads 192 bytes of memory from memory locations 400 (hex) onwards.
Line 80 - makes a copy of BUFFER$ in A$.
Line 90 - clears the screen.
Lines 100-130 - reads through A$ and POKEs it's contents onto the screen, and also sets the first 192 bytes of colour memory to white.

WHAT THE FINAL CARTRIDGE WON'T DO

This is only a short section to point out the limitations (what there are of them) of The Final Cartridge. Details are given on why certain features do not always work in order to give you a fuller understanding of The Final Cartridge's capabilities.

(1) DISK TURBO

Many commercial disk-based programs are protected and have special loading routines. It is impossible to over-ride these loading routines, and so The Final Cartridge will not attempt to do so. This means that The Final Cartridge will load as much as possible at 5 times normal speed, and then allow the loader to take over loading at normal speed. However, this problem can be overcome by re-saving the program using the freeze facility.

(2) HIGH RESOLUTION SCREEN DUMPS

There are two points to note in connection with this feature:-

(i) The picture that you wish to print should be on the screen when you attempt to print it.

(ii) The Final Cartridge will produce shades of grey in place of colour for screen dumps of pictures drawn using multi-colour graphics mode.

(3) Commercial tape programs CANNOT be made to load any faster unless you freeze them first.

Finaly if you do have a problem please re-read the instructions if ALL else fails please contact H & P Computers between 10.00am and 4.00pm Monday to Friday on (0376)511471 Or call our Bulletin Board - Amateur Radio & Computer Net on (0376)518818 open 24 hours on 300/300 1200/75 1200/1200 baud.

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FEATURES

* **DISK TURBO**

  6 times faster disk access - loading and saving

* **TAPE TURBO**

  10 times faster - compatible with standard turbo's.

* **ADVANCED CENTRONICS INTERFACE**

  compatible with all the wellknown centronics printers and Commodore printer programs. Prints all the Commodore graphics and control codes (important for listings).

  Including screen-dump facilities. Prints Low-Res, Hi-Res and Multicolour. Full page !!! Even from games and paint programs, like Doodle, Koala Pad etc. Searches automatically for the memory address of the picture.

* **24K EXTRA RAM FOR BASIC PROGRAMMS AVAILABLE**

  Two new commands ,,Memory read", ,,Memory write". They move 192 bytes with machinelanguage-speed anywhere in the 64K Ram of the CBM 64.
  Can be used with strings and variables.

* **BASIC 4.0 COMMANDS**

  like Dload, Dsave, Dappend, Catalog, etc.

* **BASIC TOOLKIT**

  with Auto, Renum (incl. Goto and Gosub), Find, Help, Old, etc.

* **PREPROGRAMMED FUNCTION KEYS**

  Run, Load, Save, Catalog, Disk commands, List (removes all list protections).

* **KEYBOARD EXTRA'S**

  Pokes and Syscalls in Hex. Type command operates your printer as a typewriter.

* **RESET SWITCH**

  Resets all protected programs.

FREEZER

* **MENU DRIVEN**

  16 SUB MENUS

  Color changes
  4 resets
  Centronics/serial screendumps
  Print vector setting
  Reverse printing
  Tape to disk, Back up
  Disk to disk, Back up
  Disk to tape, Back up

  Back ups are packed files on tape or disk, including their own fast loader and starter.

* **GAME KILLER**

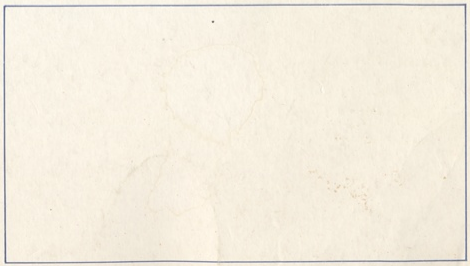
  Kills sprite to sprite and or sprite to background collision.

* **COMFORTABLE EXTENDED M.L. MONITOR**

  INCLUDING:

  Relocated load, Scrolling up and down, Bankswitching, printing

  MONITOR DOES NOT RESIDE IN RAM !!

  INCLUDES DISK DRIVE MONITOR

* **FREEZER SWITCH**